Rewarding Learning

Centre Number

Candidate Number

General Certificate of Secondary Education
2017–2018

Double Award Science: Chemistry

GSD21

Unit C1
Foundation Tier

[GSD21]

THURSDAY 22 FEBRUARY 2018, MORNING

TIME

1 hour.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all ten** questions.

INFORMATION FOR CANDIDATES

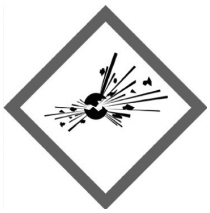
The total mark for this paper is 70.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Quality of written communication will be assessed in Question **10**.
A Data Leaflet, which includes a Periodic Table of the Elements, is included in this question paper.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Marks	

Examiner Only	
Marks	Remark

1 The diagrams below show some of the labels that appear on bottles of chemicals in the school laboratory.

(a) For each label below **draw a line** from the label to the correct risk or danger.

Label	Risk or danger
	flammable
	explosive
	corrosive
	irritant (also used for caution)
	toxic

[4]

(b) Choose the correct word from the list to complete the sentence that follows.

safety **warning** **hazard**

The labels shown in part (a) are described

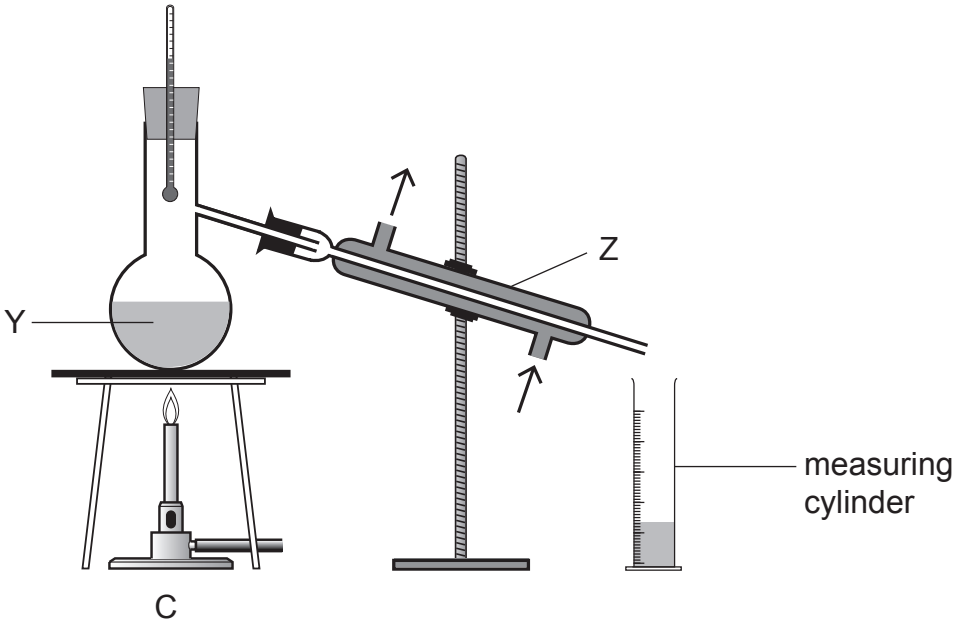
as _____ symbols. [1]

(c) Give **one** reason why symbols are used instead of words to warn of danger.

_____ [1]

Examiner Only	
Marks	Remark

2 The diagram below shows apparatus used to separate a liquid from a solution.



Choose words from the list to complete the sentences that follow.

distillate **thermometer** **evaporates** **condenser**
condenses **solute** **solvent** **soluble** **filtrate**

(a) The solution at Y contains a _____

dissolved in a _____. [2]

(b) The boiling point of the liquid is measured with

a _____. [1]

(c) When the liquid in the solution at Y boils it _____

and becomes a gas. [1]

(d) The cold water in Z means that the gas

_____ and forms a liquid. [1]

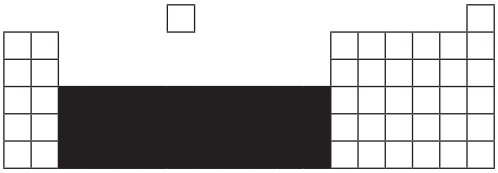
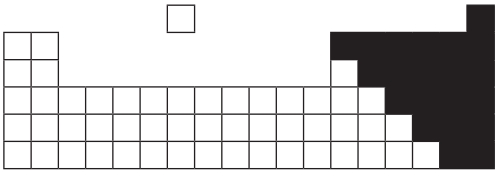
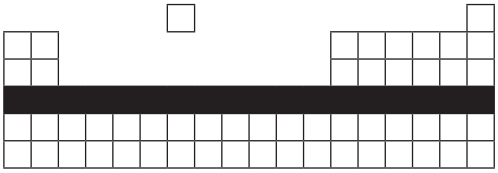
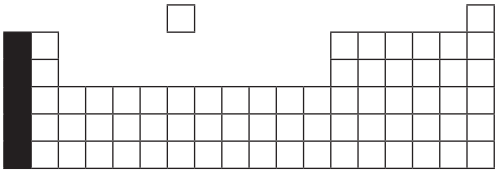
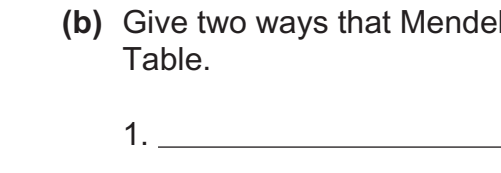
(e) The liquid that collects in the measuring cylinder is called

the _____. [1]

Examiner Only	
Marks	Remark

3 **(a)** The diagrams below show outlines of sections of the modern Periodic Table.

Match the diagrams to the correct statement by drawing straight lines.

Periodic Table outline	Statement about shaded area
	The shaded area shows non-metals only
	The shaded area shows Period 4 only
	The shaded area shows transition metals only
	The shaded area shows Group 4 only
	The shaded area shows the alkali metals only

[4]

(b) Give two ways that Mendeleev organised the elements in his Periodic Table.

1. _____

2. _____ [2]

Examiner Only

Marks	Remark

4 **(a)** The list below gives the names of some common laboratory chemicals.

ammonia **sodium chloride** **potassium hydroxide**

sulfuric acid **ethanoic acid** **sodium sulfate**

Choose from the list a chemical which is a:

(i) weak acid _____ [1]

(ii) strong alkali _____ [1]

(iii) salt _____ [1]

(b) **(i)** What pH would you expect for a solution containing a weak alkali?

Choose from the list below and circle the correct answer.

1 **4** **7** **10** **13**

[1]

(ii) What pH **range** would you expect for a solution containing hydrochloric acid?

Choose from the list below and circle the correct answer.

0–2 **0–4** **0–6** **1–3** **1–6**

[1]

(c) **(i)** Complete the word equation below:

hydrochloric acid + potassium hydroxide $\longrightarrow$ + [2]

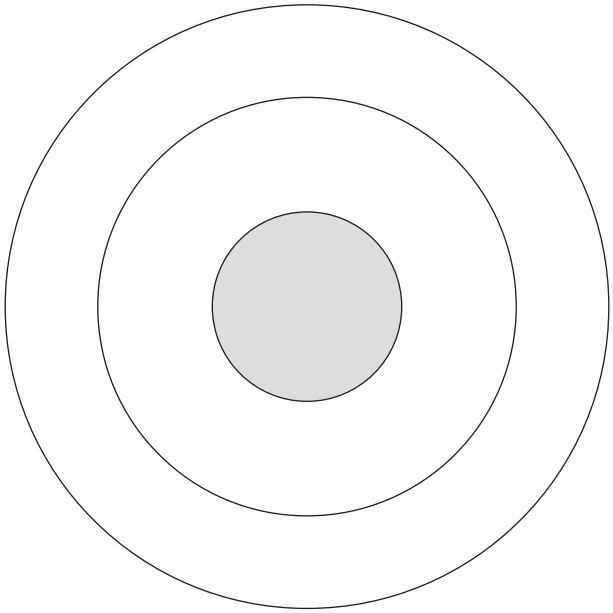
(ii) Choose the word below which describes the reaction between an acid and an alkali. Circle the correct answer.

electrolysis **displacement** **neutralisation** **combustion**

[1]

Examiner Only	
Marks	Remark

5 **(a)** Complete the diagram below to show the atomic structure of an atom of the element boron, which has an atomic number of 5 and a mass number of 11.
Include **all** the electrons, protons and neutrons. Label the particles clearly.
Use the letter **p** for each proton and **n** for each neutron. Use dots or crosses to show the arrangement of the electrons.



[4]

(b) Explain why a boron atom has no charge.

_____

_____ [1]

(c) What is meant by the term **mass number**?

_____

_____ [2]

(d) What name is used to describe atoms of the same element that have different numbers of neutrons?

_____ [1]

Examiner Only

Marks	Remark

6 Read the information about elements **X** and **Y** and then answer the questions that follow.

- X has an electronic configuration of 2,8,8,2
- Y has an electronic configuration of 2,7
- X forms an ionic bond with Y

(a) (i) How many electrons need to be transferred from an atom of element X when it bonds with element Y?

_____ [1]

(ii) How many electrons does an atom of element Y need in order to become stable?

_____ [1]

(iii) Write a formula **using the symbols X and Y** for the compound formed when they bond ionically.

_____ [1]

(b) In the space below draw a dot and cross diagram to show how covalent bonding occurs in fluorine, F_2. **All** electrons should be shown.

[3]

(c) Which one of the following statements about covalent bonds is correct?
Place a tick (✓) in the box beside the statement which is correct.

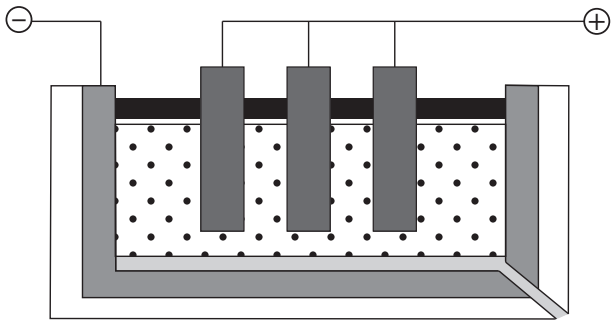
Covalent bonds are weak and need a lot of energy to break them ☐

Covalent bonds are strong and need little energy to break them ☐

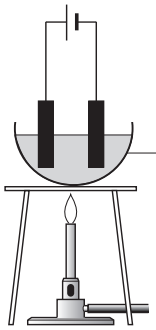
Covalent bonds are strong and need a lot of energy to break them ☐

Covalent bonds are weak and need little energy to break them ☐ [1]

7 **(a)** The diagrams below show two different electrolysis processes.



production of aluminium from aluminium oxide



The statements in the table below are about these processes. State if they are true or false by writing the correct word in the space provided.

	Statement	**True** or **False**
A	The electrodes in both processes can be made of carbon/graphite	
B	Aluminium is formed at the cathode but lithium is formed at the anode	
C	The anodes, in both processes, gradually disappear	
D	The electrolyte in both processes is molten	
E	The current is carried by ions in both processes	

[5]

(b) What is the name of the ore from which alumina (aluminium oxide) has been purified?

_____ [1]

(c) Give two reasons why it is better to recycle aluminium than to extract more of it from its ore.

1. _____

2. _____ [2]

Examiner Only

Marks	Remark

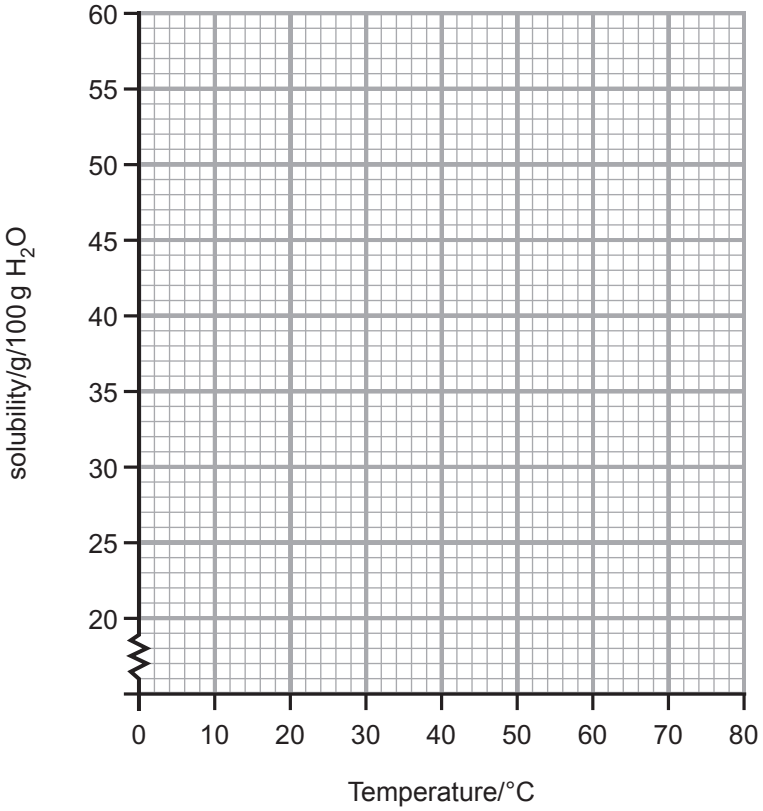
Examiner Only

Marks	Remark

8 The table below shows the results of an investigation that was carried out to find the solubility of potassium chloride in water at different temperatures.

Temperature/°C	0	10	20	30	40	50	60	70
Solubility/ g/100 g H_2O	27.8	30.9	34.0	37.1	40.0	42.9	45.8	48.5

(a) On the grid below draw the solubility curve for potassium chloride. [3]



(b) Describe the trend in solubility for potassium chloride.

_____

_____ [1]

(c) At 80 °C, 10.25 g of potassium chloride will saturate 20 g of water. Calculate the solubility of potassium chloride at 80 °C.

Show your working.

_____ g/100 g H_2O [1]

9 The table below gives information about five gold alloys.

Alloy	Percentage Gold	Percentage Other metals	Price/ g	Relative hardness
9 carat gold	37.50%	62.50%	£11.60	170
12 carat gold	50.00%	50.00%	£15.40	165
14 carat gold	58.30%		£18.10	160
18 carat gold	75.00%	25.00%	£23.20	200
22 carat gold	91.67%	8.33%	£28.30	75

(a) Complete the table by calculating the percentage of other metals present in 14 carat gold.

_____ % [1]

(b) Use the information in the table to explain why these forms of gold are described as alloys.

_____

_____ [2]

(c) **(i)** Describe the general trend in hardness for these gold alloys.

_____ [1]

(ii) Which gold alloy does not follow the general trend in hardness?

_____ [1]

(d) Suggest why 18 carat gold is a very good choice for making jewellery.

_____

_____ [2]

Examiner Only

Marks	Remark

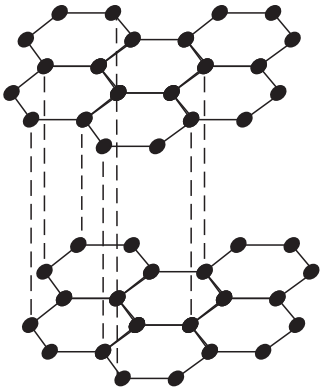
(e) Calculate the difference in cost of making a 5.0 gram bracelet from 22 carat gold or making it from 9 carat gold.

Show your working.

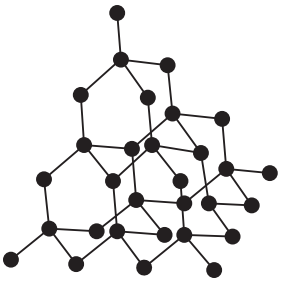
Difference in cost _____ [3]

Examiner Only	
Marks	Remark

10 The diagrams below show two structural models.



Structure A



Structure B

Both of these structures represent allotropes of carbon. Their structures mean that A and B have particular physical properties. The uses of A and B relate to their structures and properties.

Demonstrate your understanding of the above paragraph by:

- Explaining the meaning of the term “allotrope” and giving the names of the allotropes represented by Structure A and Structure B.
- Explaining why the allotrope with Structure A conducts electricity and why it can be used in pencils.
- Explaining why the allotrope with Structure B has a very high melting point and why it can be used in cutting tools.

In this question you will be assessed on your written communication skills including the use of specialist scientific terms.

The meaning of the term “allotrope” and the names of the allotropes A and B:

Examiner Only

Marks	Remark

Why allotrope A conducts electricity and why it can be used in pencils:

Why allotrope B has a very high melting point and why it can be used in cutting tools:

[6]

Examiner Only	
Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

SYMBOLS OF SELECTED IONS

Positive ions

Name	Symbol
Ammonium	NH_4^+
Chromium(III)	Cr^{3+}
Copper(II)	Cu^{2+}
Iron(II)	Fe^{2+}
Iron(III)	Fe^{3+}
Lead(II)	Pb^{2+}
Silver	Ag^+
Zinc	Zn^{2+}

Negative ions

Name	Symbol
Carbonate	CO_3^{2-}
Dichromate	$Cr_2O_7^{2-}$
Ethanoate	CH_3COO^-
Hydrogen carbonate	HCO_3^-
Hydroxide	OH^-
Methanoate	$HCOO^-$
Nitrate	NO_3^-
Sulfate	SO_4^{2-}
Sulfite	SO_3^{2-}

SOLUBILITY IN COLD WATER OF COMMON SALTS, HYDROXIDES AND OXIDES

Soluble
All sodium, potassium and ammonium salts
All nitrates
Most chlorides, bromides and iodides EXCEPT silver and lead chlorides, bromides and iodides
Most sulfates EXCEPT lead and barium sulfates Calcium sulfate is slightly soluble

Insoluble
Most carbonates EXCEPT sodium, potassium and ammonium carbonates
Most hydroxides EXCEPT sodium, potassium and ammonium hydroxides
Most oxides EXCEPT sodium, potassium and calcium oxides which react with water

Rewarding Learning

DATA LEAFLET

For the use of candidates taking
Science: Chemistry,
Science: Double Award
or Science: Single Award

Copies must be free from notes or additions of any kind. No other type of data booklet or information sheet is authorised for use in the examinations.

Contents **Page**

gcse
science
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single award

Rewarding Learning

THE PERIODIC TABLE OF ELEMENTS

Group

1	2										3	4	5	6	7	0
							1 H Hydrogen 1									4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4										11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
23 Na Sodium 11	24 Mg Magnesium 12										27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
133 Cs Caesium 55	137 Ba Barium 56	139 La* Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
223 Fr Francium 87	226 Ra Radium 88	227 Ac† Actinium 89	261 Rf Rutherfordium 104	262 Db Dubnium 105	263 Sg Seaborgium 106	262 Bh Bohrium 107	265 Hs Hassium 108	266 Mt Meitnerium 109	269 Ds Darmstadtium 110	272 Rg Roentgenium 111	285 Cn Copernicium 112						

* 58 – 71 Lanthanum series
† 90 – 103 Actinium series

a / b x
a = relative atomic mass (approx)
x = atomic symbol
b = atomic number

140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71
232 Th Thorium 90	231 Pa Protactinium 91	238 U Uranium 92	237 Np Neptunium 93	242 Pu Plutonium 94	243 Am Americium 95	247 Cm Curium 96	245 Bk Berkelium 97	251 Cf Californium 98	254 Es Einsteinium 99	253 Fm Fermium 100	256 Md Mendelevium 101	254 No Nobelium 102	257 Lr Lawrencium 103